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ABSTRACT

The purpose of a study was to identify the critical issues and problems that are and will be affecting the progress of the technology education discipline. The study used a four-round Delphi technique process to ascertain and prioritize the critical issues and problems in technology education. The panel consisted of seven secondary teachers, nine teacher educators, and nine secondary and collegiate administrators. In the first Delphi probe, panel members identified 580 items. Key descriptors were identified from each entry and grouped according to like classifications under each section of the study. Upon completion of the classification process, there were 17 items in the present issues section, 21 in the future issues section, 43 items in the present problems section, and 24 items in the future problems section. During the second Delphi probe, panel members selected and prioritized the top 15 critical issues or problems. During the third Delphi probe, panel members compared their previous analyses with the identified top issues and problems of the overall group and ranked them again. Major changes were made in each section. Greater consensus was reached in the fourth Delphi probe. An examination of the top five criteria within the sections showed that three issues/problems were identified multiple times: curriculum development concerns, knowledge base concerns, and interdisciplinary approaches to the delivery of the technology education content. (Contains 17 references.) (YLB)

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Critical Issues and Problems In Technology Education

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Critical Issues and Problems In Technology Education

The need to plan for the future is critical to the overall health of any organization. However, planning is often biased by the opinions of a select group of individuals who may not possess the knowledge and/or empirical data to formulate a plan that could address the most critical current and future concerns and issues facing the agency/institution. Most educational planning is designed for the short term (i.e., semesters, academic year) and involves establishing specific policies and procedures, often having little to do with vital targets that could be made operational for the medium and long range futures of the institution/agency. Strategic planning on the other hand, is designed to aid decision makers in making important changes based on strategically driven decisions (Goodstein, Nolan, & Pfeiffer, 1992). That is, in order to make strategic decisions, a strategic plan must be in place. Therefore, strategic planning is "the process by which the guiding members of an organization envision its future and develop the necessary procedures and operations to achieve that future" (Goodstein, et.al., 1992, p. 3). Gup (1979) perceived strategic planning to be based around three distinct yet basic questions, (1) Where are we going?; (2) What is the environment?; and (3) How do we get there? The first question revolves around the stated mission of the organization. Establishing the overall purpose of the educational agency or institution sets the direction for all activities. The driving concept and philosophy should be specified so there is a clear understanding of what "business" the organization is seeking to accomplish. In answering the second question, the decision makers must determine those factors which impact on the organization. What are the opportunities, hazards, and issues that influence the success or failure of the organization? If decision makers are to make

reasonable efforts in projecting their organization forward, they must accurately identify the mechanisms that will aid them in accomplishing their objectives and/or the obstacles that may prevent them from accomplishing their objectives. The third question, "How do we get there?" seeks to identify the approaches that could be used to achieve the successful completion of the mission of the organization.

To aid the leadership of technology education profession in formulating strategically driven decisions, and to accomplish the stated mission of advancing technological literacy, the second basic question: " What is the environment?" continually needs to be asked. The environment of technology education must be evaluated to know where and what the deficiencies are that could prevent the profession from moving forward.

Considerable effort has been made by the International Technology Education Association (ITEA) in establishing a professional improvement plan (International Technology Education Association, 1990). This strategic plan lists the six major goals of the association, followed by a number of objectives and strategies designed to establish a mechanism to aid in the accomplishment of the primary goals. Even with the professional improvement plan in place, the question must be asked, "Is this the environment of technology education?" Were the identified goals of the strategic plan established by an exhaustive evaluation of the critical issues and problems that are facing the profession currently? How assured are we that the goals and objectives identified on the professional improvement plan can solve the problems and issues facing the profession in the future? Without this information, the decision makers in technology education cannot accurately determine if their plan will address and solve the issues and problems of technology education. Waetjen (1991) identifies the need for research within technology education, he

states:

> Die-hards claim that research isn't needed and instead offer up dozens of anecdotal accounts of students who have benefitted from taking courses in technology education. But no matter how titillating the anecdotes, they simply do not convince deans, superintendents and boards of education. Only research results will be convincing. Research has moved from the periphery to the very core of the educational process. Indeed, research has established itself as a primary vehicle by which change is promoted and effected in education. Research now has a major impact on the focus, direction, and development of all aspects of education - and properly so. Can technology educators ignore this powerful force that increasingly will shape educational decisions? (p. 3).

"Technology Education: Issues and Trends" was the theme of the 1985 Technology Education Symposium VII. Donald Maley, keynote speaker at the symposium, addressed a series of perceived issues and trends for the technology education profession. Lin (1989) conducted research to investigate the nature of the current technology education movement and its impacts, problems, directions, as well as prospects for the future development technology education. Other authors have identified current issues, trends, and problems impacting on the field (i.e., Lauda, 1987; Smalley, 1988; Wenig, 1989). In 1984 the American Industrial Arts Association - Board of Directors identified "Ten opportunities which will advance the profession the most". The efforts of these individuals presented perceptions of problems and issues for technology education, they were identified through individual and/or group experiences that have relevance and may be accurate, they should not be dismissed. However, no research-based evaluation has been conducted that systematically

identifies the critical issues and problems for technology education. Therefore, if the classroom teachers, teacher educators and the supervisors/administrators of technology education hope to direct the profession into a desirable future they must understand the issues and problems that will influence the success or failure of technology education. Anyone can have opinions about the field of technology education. However, such opinions are subject to individual bias and may not support empirical data. The need to gather empirical data to accurately identify the critical issues and problems facing technology education is crucial to the future of this profession.

Purpose of This Research

In order for the leadership of the technology education profession to develop strategic plans they must have an accurate perception of the obstacles that may deter them from moving the profession forward. The purpose of this research was to determine the present and future critical issues and problems facing the technology education profession. Based upon identified critical issues and problems the leadership of the technology education profession could more accurately design a path to achieve the primary mission of advancing technological literacy.

Based on the purpose of this study, the following research questions were developed for investigation:

1. What are the critical issues that are currently impacting on the technology education discipline?
2. What are the critical problems that are currently impacting on the technology education discipline?

3. What are the critical issues that most probably will impact on the technology education disciple in the future (3-5 years)?
4. What are the critical problems that most probably will impact on the technology education discipline in the future (3-5 years)?

Methodology

The purpose of this study was to identify the critical issues and problems that are affecting and most probably will be affecting (in the future) the progress of the technology education discipline. These identified issues and problems were collected from a group of technology education professionals using the Delphi Technique designed by Dalkey and Helmer (1963) and revised by Delbecq, Van deVen, and Gustafson (1975). The primary objective of a Delphi inquiry is to obtain a consensus of opinion from a group of respondents (Salancik, Wenger and Helfer, 1971; Rojewski and Meers, 1991). Delbecq, et al. further state: "Delphi is a group process which utilizes written responses as opposed to bringing individuals together" (p. 83). Additionally, Rojewski and Meers (1991) stated that

> Typically, the Delphi technique is used to achieve group consensus among participants. Consensus is determined using the interquartile range of each research priority statement. Interquartile range refers to the middle 50% of responses for each statement (i.e., distance between first and third quartiles). (p.11).

This study used a four round Delphi Technique process to ascertain and prioritize the critical issues and problems in technology education. The use of descriptive and ordinal level data collection and analysis was used to interpret group suggestions and opinions into a collection of descriptive information for decision making.

Terms

A critical issue was defined as: Of crucial importance relating to at least two points of view that are debatable or in dispute within technology education. A critical problem was defined as: A crucial impediment to the progress or survivability of technology education. The term "present" was defined as: The current conditions under which the technology education profession is operating. The term "future" was defined as: A projected period of time of 3-5 years in the future. This span of time was judged as appropriate based on current strategic planning procedures used by the ITEA (5 year increments).

Population

The group selected for this study was composed of 25 panelists from 15 states and the District of Columbia. They represented technology education through three distinct groupings: seven (7) classroom teachers (secondary), nine (9) teacher educators (university professors) and nine (9) supervisors/administrators (secondary and collegiate). Because the success of the Delphi Technique relies upon the use of informed opinion, random selection was not considered when selecting the Delphi team. However, demographics and gender were taken into consideration when selecting the Delphi team. Each region of the ITEA was represented and four (4) women were members on the team. The participants that were selected are considered to be the well informed leading authorities in their field by their colleagues, supervisors, and peers. Criteria used in selecting the participants was based on their history of involvement in national and state professional associations representing technology education as well as their ability to formulate their thinking through writings and research. The university teacher educators of technology education and supervisors/administrators of technology education selected for the Delphi team averaged 23

years of experience in the field of industrial arts/technology education along with an average of 32 publications relating to the field of industrial arts/technology education. Selection of the classroom teachers for the Delphi team was accomplished by an identification process which used two national surveys (one to state supervisors/administrators and one to university department heads of technology education) requesting the identification of the top three classroom teachers of technology education within their state. Qualifying criteria was presented on the survey and included the following: (1) Currently teaching in a high quality secondary level technology education program; (2) Minimum of three years teaching experience as a secondary level classroom technology education teacher; (3) Prior experience in developing curriculum materials for technology education at the secondary level; (4) Creative and innovative thinkers in technology education; (5) Technically competent in their assigned teaching area; (6) Actively participates in state and national professional associations relating to technology education. The results of these surveys yielded 204 possible candidates for the Delphi team. The classroom teachers that were selected for the Delphi team were identified on both the state supervisors/administrators list and the university department heads list.

Instrumentation

Based upon the objective of providing the leadership of the technology education profession with an accurate inventory of critical issues and problems facing the field, it was determined that the forecasting abilities of the Delphi Technique would best serve this purpose. The Delphi procedure used in this study parallels the research of Helmer (1967), Linstone and Turoff (1973), and Brooks (1979).

A four probe Delphi Technique process was used to conduct the research for this

study. The panel consisted of 25 professionals, seven (7) classroom teachers, nine (9) teacher educators, and nine (9) supervisors/administrators. The first Delphi probe asked the panel to identify (exhaustively) the critical issues and problems for technology education. The issues and problems were divided into four parts: present issues, future issues, present problems, and future problems. The panel was provided a cover letter describing the process they were to follow plus definitions for the terms: critical issues, critical problems, present, and future. The second probe of the Delphi was designed to prioritize the identified issues and problems and begin the process of consensus. The third and fourth probe sought to improve the levels of consensus on the highest priority issues and problems. Descriptive statistics were used to analyze the data; critical issue and problem priority were rank ordered; means and medians were calculated for each item identified on the Delphi probes. Consensus of the prioritized critical issues and problems were determined by computing the interquartile range for each of the identified items.

Analysis of Findings

Delphi I

The first Delphi probe served as a beginning point for the study. Panel members identified a total of 580 items representing critical issues and problems for technology education. Based on the total number of identified issues and problems submitted during the first probe of the Delphi, (580 entries: 143 Present Issues, 105 Future Issues, 198 Present Problems, 134 Future Problems), key descriptors were identified from each entry and then grouped according to like classifications under each section of the study (Present Issues, Future Issues, Present Problems, and Future Problems). This procedure required the use of

a review panel composed of two university professors and one graduate student from the technology education program area at the authors' university. Upon completion of the classification process there were 17 items in the Present Issues section, 21 items in the Future Issues section, 43 items in the Present Problems section, and 24 items in the Future Problems section (see Table 1 for a listing of the collapsed category items). These classified items formed the basis for the critical problems and issues and were evaluated further during the second probe of the Delphi and subsequent following probes.

Delphi II

The purpose of the second Delphi probe was to determine the relative rank or priority of the items identified under each of the sections. Panel members were asked to select the top 15 critical issues or problems from the collapsed category list within each section. They were then asked to prioritize those top 15 issues or problems. Analysis of the responses involved a summation of each of the items along with consensus analysis within the specific sections. This initial classification of the top 15 critical issues and problems along with the analysis of consensus within the group (Interquartile Range [IQR]) are identified in Table 2. The high IQR scores indicate a wide variance of opinion in positioning the ranked items, this was not unusual for the first attempt of classifying an ordered process such as this.

Delphi III

The purpose of the third probe of the Delphi was to gain greater consensus of the top 15 critical issues and problems facing the technology education discipline. Based on the responses from probe 2, the panel members were asked to refer to their previous analysis and compare them with the identified top 15 issues and problems of the overall group. They were then asked to rank order the issues and problems again. Changes in the priority

Table 1

Collapsed Categories from Delphi Probe 1

Present Issues

Curriculum development approaches for Technology Education
Difficulty of changing from Industrial Arts to Technology Education
Identity of the knowledge base of Technology Education
Technology Education's affiliation with Vocational Education
Adequate funding sources for Technology Education
Interdisciplinary approaches to teaching Technology Education
Recruitment of students and teachers in Technology Education
Certification options and strategies for Technology Education
Methodology strategies for teaching Technology Education
Revisions and developments in teacher education for Technology Education
Professional association impact on the Technology Education discipline
International Technology Education impact on the US Technology Education discipline
Leadership (or lack of) within the Technology Education profession
Clear research agenda for Technology Education
Program closings and eliminations in Technology Education
Technological literacy concerns for Technology Education
Number of females in Technology Education

Future Issues

Curriculum development paradigms for Technology Education
Alternative vs. traditional certification designs for Technology Education
Knowledge base identification for Technology Education
Interdisciplinary approaches for Technology Education
Business & industry and political support for Technology Education
Conversion validity from Industrial Arts to Technology Education
Vocational Education influences & relationship with Technology Education
Funding of Technology Education
Positioning of Technology Education in the school program
Leadership directions and training for Technology Education
Redefining the teacher education structure for Technology Education
Defining measurable outcomes for Technology Education students
Research agenda for Technology Education
Elementary option/emphasis in Technology Education
International role and impact on Technology Education
Women and minorities in Technology Education
Combining professional associations for Technology Education
Facility design for Technology Education
Technological literacy and the role of Technology Education
Methodologies for teaching Technology Education
Overload of students in Technology Education

Table 1 Continued

Present Problems

Inadequate marketing and public relations of Technology Education
Inadequate financial support for Technology Education
Shortage of Technology Education teachers
Inadequate/inappropriate Technology Education teacher preparation
Inadequate/ineffective leadership within Technology Education
Inadequate methodological training/inservicing for Technology Education
Declining enrollments in Technology Education courses
Inappropriate facility designs for Technology Education
Deficient knowledge base for Technology Education
Insufficient research base for Technology Education
High School graduation requirements restrictions on Technology Education
Lack of consensus of curriculum content for Technology Education
Title change without content change in Technology Education
Teachers resistance to changes within Technology Education
Slow transition and retraining of teachers to Technology Education
Inaccurate understanding and support of Technology Education by administrators and counselors
Insufficient articulation/matriculation in Technology Education programs
Acceptance/respect of Technology Education by other school disciplines
Inadequate evaluation instruments for Technology Education programs
Stereotypical male domination in Technology Education
Elimination of Technology Education programs
Confusion between "Tech Prep" and Technology Education
Pre-vocational education as a narrow focus for Technology Education
Insufficient business & industry and parental support for Technology Education
Recruitment & training of women and minorities for Technology Education
Apathy and laziness of Technology Education teachers
Confusion among titles for Technology Education (IT, IA, IE, TE)
Inappropriate student accountability measures for Technology Education
Inadequate definition of technological literacy
Inadequate recognition strategies for outstanding teacher performance in Technology Education
Inadequate conference planning strategies for Technology Education
Inadequate certification criteria for advanced Technology Education curriculum
Inadequate multicultural diversity training for Technology Education
Inadequate accrediting system at the university level for Technology Education
Insufficient integration of Technology Education at the elementary level
Inadequate salaries for teachers of Technology Education
Insufficient numbers of strong doctoral granting institutions for Technology Education
Duplication of professional associations for Technology Education
Industrial Technology programs overshadowing Technology Education programs at universities
Inadequate handicapped & disadvantaged representation in Technology Education
Loss of supervisory personnel for Technology Education
Insufficient futuristic thinking in Technology Education
Inadequate integration of Technology Student Association training at the university level of Technology Education

Table 1 Continued

Future Problems

Loss of Technology Education identity, absorbed within other disciplines
Insufficient funding of Technology Education programs
Elimination of Technology Education programs
Non-unified curriculum for Technology Education
Inadequate leadership and leadership training for Technology Education
Inferior in-service training for Technology Education
Poor and/or inadequate public relations for Technology Education
Inadequate standards for Technology Education facility design
Inappropriate certification procedures for Technology Education
Inadequate research base for Technology Education
Inadequate involvement of Technology Education personnel in the overall education reform issues
Reduced opportunities for elective Technology Education based on increased high school graduation requirements
Inadequate knowledge base for Technology Education
General populous ignorance regarding technology and the discipline of Technology Education
Deficient lab-based curriculum for Technology Education
Inadequate business & industry support for Technology Education
Deficient assessment strategies for the Technology Education curriculum/discipline
Insufficient instructional materials for international programs in Technology Education
Inappropriate instructional designs and methods for Technology Education
Improper safety training for the modern Technology Education equipment
Classes too large for facilities in Technology Education
Inappropriate training for Technology Education teachers at the elementary level
Technology Education teachers adjusting to students with special needs
Insufficient quantities of Technology Education teachers and the elimination of teacher education programs in Technology Education

Table 2

Results of Delphi Probe 2

Present Issues

Rank	*Priority Statement*	*IQR*	*Mdn*
1	Curriculum development approaches for Technology Education	3.00	3.0
2	Interdisciplinary approaches to teaching Technology Education	3.50	5.0
3	Identity of the knowledge base of Technology Education	5.00	4.0
4	Recruitment of students and teachers in Technology Education	5.50	4.0
5	Adequate funding sources for Technology Education	5.00	7.0
6	Difficulty of changing from Industrial Arts to Technology Education	6.50	5.0
7	Revisions and developments in teacher education for Technology Education	6.00	7.0
8 tie	Methodology strategies for teaching Technology Education	6.00	9.0
8 tie	Certification options and strategies for Technology Education	6.50	10.0
9	Technology Education's affiliation with Vocational Education	8.50	11.0
10	Clear research agenda for Technology Education	6.00	11.0
11	Leadership (or lack of) within the Technology Education profession	7.00	11.0
12	Technological literacy concerns for Technology Education	7.00	12.0
13	Professional association impact on the Technology Education discipline	3.50	13.0
14	Program closings and eliminations in Technology Education	6.00	14.0
15	Number of females in Technology Education	5.00	14.0

Future Issues

Rank	*Priority Statement*	*IQR*	*Mdn*
1	Curriculum development paradigms for Technology Education	8.50	3.0
2	Knowledge base identification for Technology Education	9.00	5.0
3	Business & industry and political support for Technology Education	7.00	6.0
4	Interdisciplinary approaches for Technology Education	7.50	5.0
5	Positioning of Technology Education in the school program	8.50	5.0
6	Funding of Technology Education	7.00	9.0
7	Defining measurable outcomes for Technology Education students	8.50	10.0
8	Alternative vs. traditional certification designs for Technology Education	11.0	10.0
9	Leadership directions and training for Technology Education	8.50	10.0
10	Conversion validity from Industrial Arts to Technology Education	9.50	12.0
11	Elementary option/emphasis in Technology Education	7.50	12.0
12	Vocational Education influences & relationship with Technology Education	7.50	12.0
13	Technological literacy and the role of Technology Education	7.00	13.0
14	Research agenda for Technology Education	7.50	12.0
15	Methodologies for teaching Technology Education	6.50	12.0

Table 2 Continued

Present Problems

Rank	*Priority Statement*	*IQR*	*Mdn*
1	Inadequate marketing and public relations of Technology Education	4.75	2.0
2	Inadequate financial support for Technology Education	10.5	6.0
3	Lack of consensus of curriculum content for Technology Education	9.50	10.0
4	Shortage of Technology Education teachers	11.25	8.0
5	Teachers resistance to changes within Technology Education	11.75	11.0
6	Inadequate methodological training/inservicing for Technology Education	12.0	11.0
7	Inadequate/inappropriate Technology Education teacher preparation	13.75	12.5
8	Declining enrollments in Technology Education courses	11.75	16.0
9	Inadequate/ineffective leadership within Technology Education	10.5	13.0
10	Deficient knowledge base for Technology Education	10.75	16.0
11	High School graduation requirements restrictions on Technology Education	11.0	15.5
12	Insufficient research base for Technology Education	8.50	14.0
13 tie	Inaccurate understanding & support of Technology Education by administrators & counselors	7.75	12.5
13 tie	Slow transition and retraining of teachers to Technology Education	7.75	12.5
14	Insufficient business & industry and parental support for Technology Education	9.75	15.5
15	Title change without content change in Technology Education	5.00	16.0

Future Problems

Rank	*Priority Statement*	*IQR*	*Mdn*
1	Insufficient quantities of Technology Education teachers and the elimination of teacher education programs in Technology Education	3.50	1.0
2	Loss of Technology Education identity, absorbed within other disciplines	6.00	4.0
3	Poor and/or inadequate public relations for Technology Education	6.00	8.0
4	Insufficient funding of Technology Education programs	6.00	4.0
5	Non-unified curriculum for Technology Education	9.00	8.0
6	Inadequate involvement of Technology Education personnel in education reform issues	6.50	8.0
7	General populous ignorance regarding technology and the discipline of Technology Education	7.00	9.0
8	Elimination of Technology Education programs	13.0	8.0
9	Inadequate business & industry support of Technology Education	7.50	9.0
10	Inadequate leadership and leadership training for Technology Education	10.5	10.0
11	Inadequate research base for Technology Education	10.0	11.0
12	High school graduation requirements reduce opportunities for Technology Education courses	9.00	9.0
13	Inferior in-service training for Technology Education	9.00	12.0
14	Inappropriate certification procedures for Technology Education	7.50	13.0
15	Inadequate knowledge base for Technology Education	7.00	15.0

ranking from probe 2 to probe 3 can be observed in Table 3. The degree of agreement within the Delphi panel group improved, see IQR on Table 2 and IQR on probe 3 of Table 3. However, there were major changes in the priorities of the critical issues and problems within each of the sections (Present Issues, Future Issues, Present Problems, Future Problems).

Delphi IV

The consensus process was refined further during the fourth probe of the Delphi. Panel members were asked again to examine the identified critical issues and problems and to make a final judgment as to their priority of importance relevant to technology education. Based on these evaluations, greater consensus was achieved within the group as evidenced by lower interquartile range scores (see comparison of probe 3 vs. probe 4 IQR scores in Table 3). The rank order of the critical issues and problems was maintained in most instances throughout the four sections of the Delphi probe (see table 3).

Conclusions

The purpose of this research was to determine the present and future critical issues and problems facing the technology education discipline. Each of the four research questions were addressed and resulted in the identification of the top 15 critical issues and problems confronting the technology education discipline (see Table 4). The Delphi team members that identified these criteria of critical issues and problems were in overall agreement as to their character and rank order of importance (see Table 3, Probe 4 - IQR Scores). Based upon these identified critical issues and problems one may now more accurately design a path to respond to these serious concerns and problems in technology education.

Table 3

Results of Delphi Probe 3 and 4

Present Issues	*Probe 3*			*Probe 4*		
Priority Statement	*Rank*	*IQR*	*Mdn*	*Rank*	*IQR*	*Mdn*
Identity of the knowledge base of Technology Education	1	3.75	2.5	1	0.00	1.0
Curriculum development approaches for Technology Education	2	4.50	2.5	2	0.75	3.0
Interdisciplinary approaches to teaching Technology Education	3	3.75	4.0	3	0.00	3.0
Revisions and developments in teacher education for Technology Education	4	3.00	6.0	4	0.00	4.0
Difficulty of changing from Industrial Arts to Technology Education	5	4.75	6.0	5	1.75	5.0
Recruitment of students and teachers in Technology Education	6	7.00	4.5	6	0.00	6.0
Methodology strategies for teaching Technology Education	7	5.00	8.0	7	0.00	7.0
Adequate funding sources for Technology Education	8	4.75	6.5	8	0.00	8.0
Technological literacy concerns for Technology Education	9	5.75	9.5	9	0.00	9.0
Clear research agenda for Technology Education	10	6.75	11.0	10	0.00	10.0
Certification options and strategies for Technology Education	11	3.75	10.0	11	0.00	11.0
Program closings and eliminations in Technology Education	12	6.25	13.0	13	0.75	12.0
Leadership (or lack of) within the Technology Education profession	13	5.50	11.5	12	1.00	13.0
Professional association impact on the Technology Education discipline	14	5.00	13.0	14	0.00	14.0
Technology Education's affiliation with Vocational Education	15	4.00	13.0	15	0.00	15.0

Future Issues	*Probe 3*			*Probe 4*		
Priority Statement	*Rank*	*IQR*	*Mdn*	*Rank*	*IQR*	*Mdn*
Curriculum development paradigms for Technology Education	1	7.00	2.0	1	0.00	1.0
Positioning of Technology Education in the school program	2	4.50	4.0	2	0.00	2.0
Knowledge base identification for Technology Education	3	4.75	4.0	3	0.00	3.0
Interdisciplinary approaches for Technology Education	4	3.75	4.5	4	0.00	4.0
Business & industry and political support for Technology Education	5	6.75	4.5	5	0.00	5.0
Redefining the teacher education structure for Technology Education	6	4.00	6.5	6	0.00	6.0
Funding of Technology Education	7	6.75	7.0	7	0.00	7.0
Defining measurable outcomes for Technology Education students	8	6.75	8.0	8	0.00	8.0
Leadership directions and training for Technology Education	9	5.00	10.0	9	0.75	9.0
Elementary option/emphasis in Technology Education	10	7.50	9.5	10	0.00	10.0
Methodologies for teaching Technology Education	11	5.50	10.5	11	0.00	11.0
Technological literacy and the role of Technology Education	12	6.00	11.5	12	0.00	12.0
Research agenda for Technology Education	13	5.75	10.5	13	0.00	13.0
Alternative vs. traditional certification designs for Technology Education	14	3.75	13.0	14	0.00	14.0
Conversion validity from Industrial Arts to Technology Education	15	6.00	13.5	15	0.00	15.0

Table 3 Continued

Present Problems	*Probe 3*			*Probe 4*		
Priority Statement	*Rank*	*IQR*	*Mdn*	*Rank*	*IQR*	*Mdn*
Inadequate marketing and public relations of Technology Education	1	6.75	3.5	1	0.00	1.0
Lack of consensus of curriculum content for Technology Education	2	6.25	4.5	2	1.00	2.0
Inaccurate understanding and support of Technology Education by administrators and counselors	3	4.00	6.0	4	0.00	3.0
Teachers resistance to changes within Technology Education	4	4.25	6.0	3	0.00	4.0
Inadequate financial support for Technology Education	5	9.50	6.0	5	0.00	5.0
High School graduation requirements restrictions on Technology Education	6	9.75	7.5	6	0.00	6.0
Slow transition and retraining of teachers to Technology Education	7	4.50	8.5	7	0.75	7.0
Inadequate/inappropriate Technology Education teacher preparation	8	7.50	8.5	9	0.75	8.0
Shortage of Technology Education teachers	9	7.25	8.5	8	0.00	9.0
Inadequate methodological training/inservicing for Technology Education	10	7.00	10.0	11	1.00	10.0
Declining enrollments in Technology Education courses	11	5.75	9.5	10	0.00	11.0
Deficient knowledge base for Technology Education	12	6.50	10.0	12	0.00	12.0
Insufficient research base for Technology Education	13	7.25	11.0	13	1.00	13.0
Title change without content change in Technology Education	14	6.00	10.5	14	0.00	14.0
Inadequate/ineffective leadership within Technology Education	15	5.75	11.5	15	0.00	15.0

Future Problems	*Probe 3*			*Probe 4*		
Priority Statement	*Rank*	*IQR*	*Mdn*	*Rank*	*IQR*	*Mdn*
Insufficient quantities of Technology Education teachers and the elimination of teacher education programs in Technology Education	1	6.00	4.0	1	0.00	1.0
Loss of Technology Education identity, absorbed within other disciplines	2	5.50	3.0	2	0.00	2.0
Poor and/or inadequate public relations for Technology Education	3	6.50	4.0	3	0.00	3.0
General populous ignorance regarding technology and the discipline of Technology Education	4	5.50	5.0	5	0.00	4.0
Non-unified curriculum for Technology Education	5	7.00	5.5	4	0.75	5.0
Inadequate involvement of Technology Education personnel in education reform issues	6	6.75	6.0	6	0.00	6.0
Insufficient funding of Technology Education programs	7	4.00	6.0	9	0.00	7.0
Elimination of Technology Education programs	8	8.75	9.0	7	1.00	8.0
High school graduation requirements reduce opportunities for Technology Education courses	9	5.75	9.0	8	0.75	9.0
Inadequate business & industry support of Technology Education	10	6.75	9.0	10	0.00	10.0
Inadequate research base for Technology Education	11	6.75	9.5	11	0.00	11.0
Inadequate knowledge base for Technology Education	12	5.00	12.0	12	0.00	12.0
Inadequate leadership and leadership training for Technology Education	13	4.75	11.0	13	0.00	13.0
Inferior in-service training for Technology Education	14	4.75	12.0	14	0.00	14.0
Inappropriate certification procedures for Technology Education	15	3.50	12.5	15	0.00	15.0

Table 4

Final Results of Delphi on Critical Issues and Problems in Technology Education

Present Issues

Rank	*Priority Statement*
1	Identity of the knowledge base of Technology Education
2	Curriculum development approaches for Technology Education
3	Interdisciplinary approaches to teaching Technology Education
4	Revisions and developments in teacher education for Technology Education
5	Difficulty of changing from Industrial Arts to Technology Education
6	Recruitment of students and teachers in Technology Education
7	Methodology strategies for teaching Technology Education
8	Adequate funding sources for Technology Education
9	Technological literacy concerns for Technology Education
10	Clear research agenda for Technology Education
11	Certification options and strategies for Technology Education
12	Leadership (or lack of) within the Technology Education profession
13	Program closings and eliminations in Technology Education
14	Professional association impact on the Technology Education discipline
15	Technology Education's affiliation with Vocational Education

Present Problems

Rank	*Priority Statement*
1	Inadequate marketing and public relations of Technology Education
2	Lack of consensus of curriculum content for Technology Education
3	Teachers resistance to changes within Technology Education
4	Inaccurate understanding and support of Technology Education by administrators and counselors
5	Inadequate financial support for Technology Education
6	High School graduation requirements restrictions on Technology Education
7	Slow transition and retraining of teachers to Technology Education
8	Shortage of Technology Education teachers
9	Inadequate/inappropriate Technology Education teacher preparation
10	Declining enrollments in Technology Education courses
11	Inadequate methodological training/inservicing for Technology Education
12	Deficient knowledge base for Technology Education
13	Insufficient research base for Technology Education
14	Title change without content change in Technology Education
15	Inadequate/ineffective leadership within Technology Education

Future Issues

Rank	*Priority Statement*
1	Curriculum development paradigms for Technology Education
2	Positioning of Technology Education in the school program
3	Knowledge base identification for Technology Education
4	Interdisciplinary approaches for Technology Education
5	Business & industry and political support for Technology Education
6	Redefining the teacher education structure for Technology Education
7	Funding of Technology Education
8	Defining measurable outcomes for Technology Education students
9	Leadership directions and training for Technology Education
10	Elementary option/emphasis in Technology Education
11	Methodologies for teaching Technology Education
12	Technological literacy and the role of Technology Education
13	Research agenda for Technology Education
14	Alternative vs. traditional certification designs for Technology Education
15	Conversion validity from Industrial Arts to Technology Education

Future Problems

Rank	*Priority Statement*
1	Insufficient quantities of Technology Education teachers and the elimination of teacher education programs in Technology Education
2	Loss of Technology Education identity, absorbed within other disciplines
3	Poor and/or inadequate public relations for Technology Education
4	Non-unified curriculum for Technology Education
5	General populous ignorance regarding technology and the discipline of Technology Education
6	Inadequate involvement of Technology Education personnel in education reform issues
7	Elimination of Technology Education programs
8	High school graduation requirements reduce opportunities for Technology Education courses
9	Insufficient funding of Technology Education programs
10	Inadequate business & industry support of Technology Education
11	Inadequate research base for Technology Education
12	Inadequate knowledge base for Technology Education
13	Inadequate leadership and leadership training for Technology Education
14	Inferior in-service training for Technology Education
15	Inappropriate certification procedures for Technology Education

Trend Extrapolation

With the identification of the critical problems and issues in technology education several trends surfaced. In an examination of the top five (5) criteria within the issues and problems sections of this research, three (3) issues/problems were identified multiple times. The most prominent criterion (identified within the top five critical issues and problems in all four sections) was the aspect of curriculum development concerns. ***Curriculum development approaches, curriculum development paradigms, lack of consensus of curriculum content, and non-unified curriculum*** were identified in each of the research sections respectively. This indication of curriculum concerns within the top five issues and problems sections was evidence of the strong need to design technology education curriculum that addresses a comprehensive approach to curriculum development. Although recent publications have identified a curriculum framework for technology education (Savage and Sterry, 1991) that have provided an overall orientation for the curriculum, there was an identified need to develop this effort further and to establish a unified curriculum that would serve as a standard. The second criterion that was identified multiple times within the top five (5) critical issues and problems for technology education was the aspect of knowledge base concerns. The ***identity of the knowledge base for technology education*** was indicated in both the present issues and future sections ranking number 1 and 3 respectively (see Table 4). The need to establish a formal knowledge base was viewed as foundational to the future of technology education. A formal knowledge base would help in establishing needed precedents for future development within the field. The final criteria that was identified more than once in the top five (5) critical issues and problems sections was the concept of interdisciplinary approaches to the delivery of the technology education content.

Interdisciplinary approaches to teaching technology education was selected as number 3 and 4 within the present issues and future issues section of this research. The need to integrate technology education with other disciplines was viewed as an essential element to the success of the discipline.

Although not listed in the top five critical issues and problems several other criteria were identified as tendencies of critical importance to the discipline of technology education. The issue/problem of improving the public awareness of technology education through a variety of public relation efforts was indicated seven (7) times in this research. The need to gain the support of school administrators, school counselors, other teachers within the school, business and industry representatives, parental support and recognition by the overall populace was viewed as critical to the future development of technology education. Problems and issues related to teacher education programs were identified six (6) times within the various sections of this research. The need to change the way teacher education institutions prepare technology education teachers was viewed as essential; of major concern was the type of methodological instruction that was to be incorporated in the classroom. Equally concerning was the slowness or reluctance to change from industrial arts to technology education. Six (6) times the Delphi panel indicated that the slow approach that teachers were taking to change from industrial arts to technology education was a critical issue or problem for technology education. The perceived validity of the change from industrial arts to technology education was associated with this reluctance to change.

Other critical areas were identified within the four sections of this research. Funding issues and problems were identified four (4) times; the creation of a research agenda for technology education was identified four (4) times; leadership issues and concerns were

identified four (4) times; certification considerations and problems were identified three (3) times; and the elimination of programs and enrollment problems in technology education classes were identified three (3) times. The identification of these issues and problems may serve to aid the leadership of technology education in formulating solutions for the future of the discipline.

The 1990-95 Professional Improvement Plan published by the ITEA (1990) stated that the primary mission of the association was to advance technological literacy. The association presented six major goals designed to aid in the achievement of the overall mission. Of the six goals, five were addressed specifically in the results from this research. This correlation was an indication that the efforts of the ITEA Professional Improvement Plan was working in an appropriate direction to address the pressing concerns and difficulties of technology education. It also indicated that the assumed positions of the ITEA were confirmed as relevant positions for the technology education profession. In addition to the Professional Improvement Plan, many other areas of need were identified in this research and should be further evaluated for possible actions.

Implications and Recommendations

The issues and problems that were identified in this research can serve as a foundational basis for future developmental efforts as well as evaluation criteria. By addressing the issues and problems, the leadership of the technology education discipline can proactively establish specific task force action groups to meet these challenges, strategically marshalling their use of human and physical resources.

Based on these findings the following recommendations are put forward:

1. Curriculum development should be given priority in further study and developmental efforts. The development of technology education curriculum with a central theme and high standards needs to be established at a national level and implemented at the state and local school levels.
2. Greater emphasis should be placed on the development of the knowledge base for the technology education field of study. The need to further identify the working theories and concepts of technology education must be addressed inorder for the field to move forward as a legitimate academic discipline.
3. Serious efforts should be established and implemented to communicate the purpose and scope of technology education to decision makers and interested people groups. All levels of technology education teachers and administrators need to be made aware of this serious issue/problem of public relations, positioning, and support gathering.
4. The Executive Director and the Board of Directors of the International Technology Education Association should evaluate the identified critical issues and problems and establish task force groups that will address the specific issues and problems.
5. Further research needs to be conducted to determine the views and perceptions of the rank and file teachers of technology education on perceived critical issues and problems for technology education.
6. Research of this type needs to be conducted periodically (every two to three years) to keep the technology education profession aware of needs and changing dynamics.

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